# The "Fernald Approach" to Technology Deployment

**FINAL PROJECT REPORT**

**The Fernald Environmental Management Project**
**Accelerated Site Technology Deployment**

*Sponsored by*

**U.S. Department of Energy**
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Fernald
Environmental Management Project

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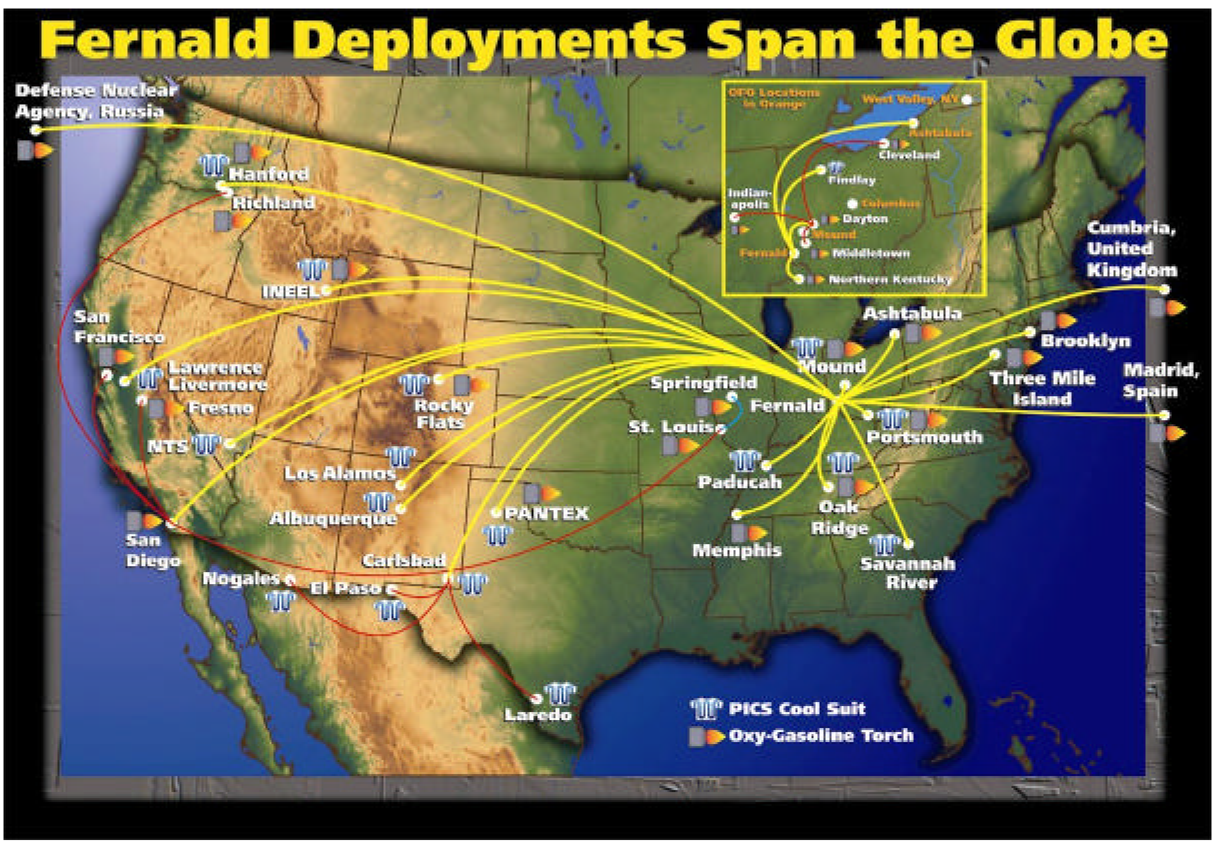

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## Project Summary

This report details the results and accomplishments of the Fernald Accelerated Site Technology Deployment (ASTD) Project. The Department of Energy (DOE) Office of Science and Technology (OST) created the ASTD program to promote the transfer of new or innovative technologies that are capable of accelerating facility Deactivation and Decommissioning (D&D). Fluor Fernald, Inc., took the OST's commitment to technology deployment one step further and devised a project intended to overcome the traditional challenges to technology deployment. The Fernald ASTD Project developed the "Fernald Approach" to deploy previously demonstrated, proven (faster, safer, and/or lower cost) technologies to end-users at the Fernald Environmental Management Project (Fernald), other DOE cleanup sites, and training organizations/institutions throughout the United States.

The Fernald ASTD project began in March of 1998 and ended in December of 2000. During that time, Fernald deployed the Personal Ice Cooling System (PICS) and/or oxy-gasoline torch to 24 sites across the country. The technologies deployed through this project were chosen for their demonstrated superiority to baseline technologies in the areas of worker safety, productivity, and cost-effectiveness. The keystone of this deployment effort was its ability to connect technology end-users and managers directly with the PICS and oxy-gasoline torch. Skilled deployment teams conducted hands-on demonstrations at each deployment site, providing technology "seed units" at no risk and with no strings attached to the sites, as warranted. At last count, more than 250 oxy-gasoline torches and 200 PICS units were deployed as a result of this ASTD project, either as seed units or follow-up purchases.

Fluor Fernald's innovative approach to technology deployment had enduring effects on those who participated in the project. Technology vendors were able to expand their client base. Project managers and technology end-users gained experience with new technologies and a more positive outlook on the concept of technological change. Training institutions obtained valuable educational tools in the PICS and oxy-gasoline torch, ensuring that the benefits of these technologies will spread throughout the DOE for years to come as trainees enter the workforce. Deployment sites acquired technologies capable of enhancing worker safety, accelerating project schedules, and generating significant cost savings when used in place of baseline methods. Using three oxy-gasoline torches instead of three oxy-acetylene torches to perform a typical D&D job (steel thickness varying from less than 0.5 inch to more than four inches) would generate a cost savings of approximately $105,000 and a schedule reduction of four months. Over the seven-year life expectancy of three oxy-gasoline torches, one site could generate cost savings of $735,000. A cost savings estimate for the PICS, based on a project involving 16 workers, projected annual savings in the range of $124,000.

The Fernald ASTD Project illustrated that successful technology deployments are achievable with careful planning, sufficient resource allocation, and open communication among all those involved in the process. The Fernald Approach provided end-users with a risk-free opportunity to experience the benefits of innovative technologies, breaking down the traditional barriers to deployment.

# INTRODUCTION

## The Accelerated Site Technology Deployment Program

The DOE-OST developed the ASTD program in response to a growing demand throughout the DOE complex for the expedited deployment of technological solutions to the challenges of site cleanup. New or innovative technologies have the potential to improve worker safety, reduce cost, and/or shorten project schedules by increasing productivity. Nevertheless, current and projected Environmental Management (EM) budget constraints preclude the expedient qualification and deployment of innovative technologies or processes. The ASTD program was created in 1997 to provide DOE sites with the means and incentives to identify and deploy technologies and processes capable of accelerating cleanup throughout the DOE complex. Specifically, the mission of the ASTD program is to deploy technologies that improve worker safety, reduce costs, accelerate site cleanup, and support the goals and schedules identified in the document entitled “Accelerating Cleanup: Paths to Closure” (DOE/EM-0342).

## The Challenges of Deployment

In theory, technology deployment is a fairly straightforward process; however, barriers exist which may hinder its success in practice. For a deployment project to be effective, the deployment team must be intimately familiar with the technology and the problem it is designed to address. The team also must work closely with those who will be using the new or innovative technology in the field (technology end-users). Several layers of management exist at DOE sites, making it difficult for deployment teams to contact actual end-users. Although managers may recognize the benefits of a new or innovative technology on paper, they may not be able to detect performance differences between the innovative technology and the baseline in practice, since they may not be accustomed to working with the baseline directly. After first-hand experience with a new or innovative technology, skilled end-users can recognize performance differences immediately. Therefore, it is crucial that deployment teams demonstrate new or innovative technologies to experienced end users as well as project managers.

Involving technology end-users in the deployment effort does not guarantee a smooth transition to the use of new or innovative technology. Field employees and project managers tend to resist change, particularly when they have the option of retaining a “tried-and-true” technology or process. Many baseline technologies in the D&D industry have been used for years, and it can be difficult to convince field employees that an alternative technology can do the job better. Even after workers learn about new technology through media such as Innovative Technology Summary Reports (ITSRs), videos, and slide presentations, they often remain skeptical until they experience the benefits of the technology first hand. First-hand observation is also important to project managers, who are generally reluctant to devote funds to a new technology or process without witnessing evidence that it performs effectively.

Another potential barrier to successful deployment is a lack of communication between the technology vendor and end-users. The vendor is intimately familiar with the technology and its capabilities. When the vendor is not involved with the deployment, as the case has been in past projects, end-users have little opportunity to ask specific questions about the technology or to learn about custom features that could improve the product’s ability to serve particular needs.

# THE FERNALD ASTD PROJECT

## The Fernald Approach

Fluor Fernald developed an innovative approach to the difficult task of technology deployment. The Fernald ASTD Project was designed to deploy innovative technologies, shown to have superior safety, cost, and performance benefits, to the Fernald Environmental Management Project, other DOE sites, and training organizations. The most important element of this project was its utilization of the “Fernald Approach,” pioneered by Fluor Fernald to overcome the challenges described in the previous section and to establish a direct connection between end-users and winning technologies. The “Fernald Approach” to technology deployment is characterized by the following elements:

- Start with a “winning” technology
- Utilize an experienced deployment team
- Establish a sustained marketing mindset
- Communicate directly with technology end-users
- Conduct site visits to take the technology to end-users
- Involve the technology vendor
- Perform live demonstrations, hands-on training, and provide supporting documentation
- Provide technology “seed units,” when applicable
- Reduce risk to end-users
- Collect post-deployment feedback from end-users

Fluor Fernald focused on specific venues for its technology demonstrations: DOE sites and training institutions. This approach was designed to reach D&D workers now and in the future. The men and women currently working in the field could benefit greatly from improved D&D technologies. In turn, they are likely to share information about new technologies with workers at other sites. Training organizations are an equally important target audience, as they educate the D&D workers of the future. Thousands of students pass through training institutions each year. By including these organizations in the deployment effort, Fluor Fernald guaranteed that a whole new generation of D&D workers would be exposed to the benefits of innovative technology each year. As trainees move on to various industry jobs, they can share their training experiences with others and request that the oxy-gasoline torch and PICS be used for specific projects, when applicable. The inclusion of training institutions is also an effective way to disseminate information, since instructors develop a broad range of contacts within the environmental and nuclear remediation industries.

## Technology Description

At the beginning of the project, Fluor Fernald selected two winning technologies for deployment: the oxy-gasoline torch and the Personal Ice Cooling System. The oxy-gasoline torch and the PICS, originally demonstrated in 1996 and 1997 during the Fernald Large Scale Technology Demonstration and Deployment Project (LSDDP), were proven to significantly improve worker safety, reduce costs, and shorten project schedules when used in place of baseline steel segmentation and heat stress control methods. Both technologies were fully developed and readily available for purchase prior to deployment. Brief cost savings estimates for the oxy-gasoline torch and the PICS and are included in the Results section of this report. More detailed performance and cost data can be found in the ITSR for each technology, available at http://ost.em.doe.gov/Itsrddfa.html.

- Oxy-Gasoline Torch (Tech ID: 1847)
- PICS (Tech ID: 1898)

## Deployment Process

Fernald's ASTD Project was designed to share the PICS and oxy-gasoline torch with sites that could benefit from one or both of the technologies. Some sites were specifically targeted by Fernald, while others took the initiative to contact Fernald after hearing about the project. Each site had to demonstrate a need for either the PICS or the oxy-gasoline torch before an actual deployment could be conducted.

A deployment team was assembled to conduct technology transfer sessions. The team consisted of technology vendors and personnel from Fernald's Technology Programs department, through which the ASTD Project was administered. Members of the deployment team were selected specifically because they:

- Understood why the technology was needed
- Understood the technology through first-hand experience
- Understood the end-user
- Understood the barriers to deployment
- Understood the problem (e.g., heat stress, steel segmentation)

**Figure 1.** Versailles Vocational School and Local 42 Cincinnati Iron Workers receive oxy-gasoline torch for integration into their training curriculum. *7335-6*

After contact was made with each deployment site, Fernald ASTD Project personnel initiated a dialogue with the site's technology representative. Information exchange sessions were held to familiarize the technology representatives, who generally consisted of Technical Program Officers (TPOs) at DOE sites and program directors at training organizations, with the PICS and/or oxy-gasoline torch technology. The TPO of each site in turn contacted project managers and supervisors to determine the need for innovative technology. This process provided site representatives with an overview of each technology's purpose and capabilities, information which allowed them to determine if the technology was applicable to site projects.

Once site-specific project needs and end-users were identified, a technology transfer session was scheduled at each deployment site. The purpose of the technology transfer session was to establish a direct link between the new technology, its vendor or supplier, and potential end-users. Prior to the technology transfer session, functional technology samples were delivered to each deployment site (See Figure 1). The samples, or seed units, were used during the deployment presentation to demonstrate the PICS and/or oxy-gasoline torch to end-users and their direct managers. When applicable, the units were then left at the site for use in actual field projects.

**Figure 2.** PICS vendor (right) teaches instructors at the University of Findlay Environmental Resource Training Center how to use the cool suit. *7335-15*

During each technology transfer session, participants were exposed to a variety of educational tools. ITSRs, detailing cost and performance data for the technology being deployed, were distributed for review. Meeting participants also watched a slide presentation and video on the technology being deployed. The deployment team then involved end-users in a hands-on demonstration of the PICS or the oxy-gasoline torch (See Figure 2). Participants were able to work directly with the technologies, just as they would in the field. At DOE sites, the seed units were given to work groups to use in actual field projects.

Following the technology transfer session, participants were requested to complete feedback surveys. Surveys evaluated the effectiveness of the "Fernald Approach" and assessed the responsiveness of end-users and managers to new technologies. Feedback surveys were a particularly important component of this ASTD project, as they opened a direct line of communication between the deployment team and the main targets of the deployment effort. Survey results are summarized in Appendix D.

# RESULTS

Fernald's visionary approach to technology deployment has had a significant impact on the D&D industry. Fernald deployed 126 PICS and 19 oxy-gasoline torches as seed units to 24 primary deployment sites (shown in Table 1). However, the overall impact of the Fernald ASTD Project has actually been much greater, due to the outward spread of innovative technology from the primary deployment sites. Many sites have procured additional PICS or oxy-gasoline torches directly from the vendors and deployed the technologies to other sites. Including secondary and tertiary deployments, the estimated number of Personal Ice Cooling Systems deployed as a result of Fernald's efforts exceeds 200 units; the estimated number of oxy-gasoline torches exceeds 250 units. These figures continue to climb.

**Table 1. Primary Technology Deployment Locations / Seed Units Provided**

| SITE | PICS | Oxy-Gasoline Torch |
|---|---|---|
| Ashtabula | ✔ | ✔ |
| Argonne National Laboratory | ✔ | |
| Carlsbad | ✔ | |
| Center to Protect Workers Rights | ✔ | |
| Cincinnati Iron Workers, Local 44 | | ✔ |
| Columbus Environmental Management Project | ✔ | ✔ |
| Fernald Environmental Management Project | ✔ | ✔ |
| Great Oaks, Hamilton Co. Vocations School | | ✔ |
| Hanford | ✔ | ✔ |
| Iron Workers, Dayton Local 290 | | ✔ |
| Lawrence Livermore National Laboratory | ✔ | |
| Los Alamos National Laboratory | ✔ | |
| Mound Environmental Management Project | ✔ | |
| Nevada Test Site | ✔ | |
| Oak Ridge | ✔ | |
| Paducah Gaseous Diffusion Plant | ✔ | |
| Pantex | ✔ | |
| Portsmouth Gaseous Diffusion Plant | ✔ | ✔ |
| Rocky Flats | ✔ | |
| Sandia National Laboratory | ✔ | |
| Savannah River | ✔ | |
| University of Findlay Environmental Response Training Center | ✔ | |
| Volpentest HAMMER Facility | ✔ | ✔ |
| West Valley Demonstration Project | ✔ | ✔ |

The "Fernald Approach" to technology deployment provided distinct benefits to the parties involved. Technology end-users and project managers benefited from direct experience with innovative technologies. While slide presentations, videos, and literature familiarized end-users and managers with the broad technical capabilities of the PICS and/or oxy-gasoline torch, hands-on demonstrations allowed the participants to see how each technology could work specifically for them. Allowing project managers and end-users to work with technology seed units gave the participants an opportunity to experience the benefits of innovative technology without the risk of investing in an unfamiliar product or process. These observations are evidenced by the positive feedback provided by recipients of technology deployments. User feedback surveys were administered to site workers and trainees following each technology transfer session; a total of 249 surveys was completed. An example of a completed survey form is shown in Appendix B, followed by a comprehensive summary and analysis of all survey results in Appendix D. A number of deployment sites sent feedback letters in lieu of formal survey responses; examples of these letters are provided in Appendix C.

The participation of technology vendors in the Fernald ASTD Project was profitable to both the technology recipients and the vendors themselves. Vendors participated at their own expense, attending the technology transfer sessions at nearly all of the deployment sites. The active participation of technology vendors helped to make a positive impression on skeptical end-users, who engaged the vendors in detailed discussions about the capabilities of each

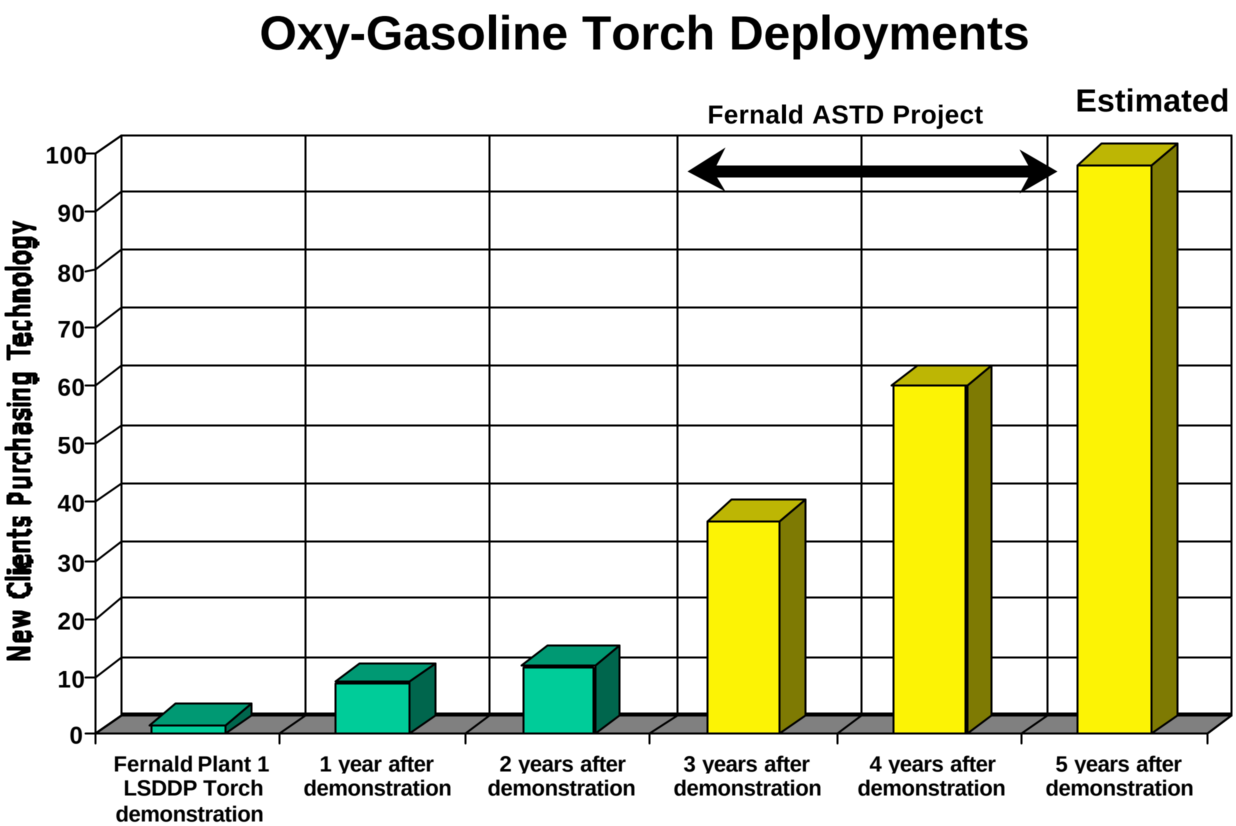


**Figure 3:** Effect of the Fernald ASTD Project on new purchases of oxy-gasoline torch

technology. Vendors were able to share their intimate knowledge of each technology and discuss product customization options in response to site-specific needs. Interaction with technology end-users also helped the vendors by expanding their client base and, on occasion, augmenting their knowledge of their own products. During the PICS deployment, for example, the technology manufacturer realized that the product line could be improved by offering individually-sized vests instead of the adjustable, one-size-fits-most vests that had been offered exclusively prior to the deployment. Figure 3 illustrates how a focused deployment effort can maximize the impact of a successful technology demonstration by "spreading the word" about a winning technology, in this case the oxy-gasoline torch.

The inclusion of training institutions in the Fernald deployment effort proved to be extremely effective. Once the PICS and oxy-gasoline torch were integrated into the training programs of participating institutions, the technologies spread quickly to end-users. For example, the Center to Protect Workers' Rights has trained over 100 hazardous waste workers at DOE sites on the PICS technology since receiving PICS units from Fernald. These figures represent only one of the training institutions involved in the Fernald ASTD Project. The overall impact of the collaboration between Fernald and training institutions is significant, considering how many future D&D workers receive training at these organizations. Each year, the University of Findlay Environmental Resource Training Center trains approximately 9,000 workers in environmental remediation techniques; including personnel from the DOE, federal and state environmental agencies, local fire departments, private industry, and universities.

# COST SAVINGS ESTIMATES

Use of the PICS and/or oxy-gasoline torch could result in potentially significant long-term savings for deployment sites. The following cost savings estimates were based on technology deployments at Fernald.

## Cost Savings Estimate – Personal Ice Cooling System

This estimate is limited to a basic calculation of dollars saved through the deployment of ten PICS systems and two central chillers (stationary cooling units that can accommodate up to five workers each) via the Fernald ASTD Project during warm-weather months. Estimated savings are realized through significant increases in remediation work stay time, over baseline cooling methods, when ambient temperatures are high enough to present a heat stress threat. The ITSR (OST Reference #1898) for the PICS compares its operational costs and performance data to those of the baseline heat stress mitigation method (reduced worker stay-time). According to the ITSR, using the PICS will generate a cost savings of \$47/crew-hour when ambient temperatures fall between 70° and 85°F and a cost savings of \$159/crew-hour when temperatures exceed 85°F. Table 2 displays average temperature data over a 30-year period during the warm-weather months in Cincinnati.

**Table 2. National Weather Service temperature data for Cincinnati, Ohio (1961-1990)**

| °F | May | June | July | August | September |
|---|---|---|---|---|---|
| **Average Temperature** | 62.9 | 71 | 75.1 | 73.5 | 67.3 |
| **Average High Temperature** | 79 | 85 | 86 | 86 | 83 |

The following assumptions have been made to simplify the cost savings estimate for the PICS:

From May to September, field work is conducted for an average of four weeks per month. At Fernald, remediation work is performed in one 10-hour shift per day for four days each week. Over four weeks, this translates into an average of 160 working hours per month.

For the months of May, June, and September, it is conservatively assumed that, during half the work day, the average temperature will be below 70°F and the PICS will not be used, even though interior building temperatures can often far exceed ambient temperatures due to heat build-up from sunshine and limited ventilation. It is further conservatively assumed that, during the same months, the ambient temperature will fall between 70°F and 85°F at least one quarter of the time and that workers will use the PICS under these conditions.

For the months of July and August, it is conservatively assumed that the ambient temperature will be between 70°F and 85°F for one quarter of the work day and above 85°F for another quarter of the day. The PICS would therefore be used for one half of the work day. To account for normal work, safety, and lunch breaks, it is further assumed that only 70 percent of the total work time will actually be used to perform field work.

Based on the previous assumptions, Table 3 shows the estimated cost savings generated by PICS use at the Fernald Environmental Management Project.

**Table 3. Estimated cost savings generated by PICS use at Fernald**

| Month | Working Hours at 70° B 85° F | Hourly Saving with PICS at 70° B 85° F | Working Hours at > 85° F or Higher | Hourly Saving with PICS at 85° F or Higher | Monthly Savings Per Two Person Crew |
|---|---|---|---|---|---|
| May | 28 | $47 | 0 | $159 | $1,316 |
| June | 28 | $47 | 0 | $159 | $1,316 |
| July | 28 | $47 | 28 | $159 | $5,768 |
| August | 28 | $47 | 28 | $159 | $5,768 |
| September | 28 | $47 | 0 | $159 | $1,316 |
| | | | | **Yearly Savings Per 2 Man Crew** | $15,484 |
| | | | | **Yearly Savings Per Worker** | $7,742 |

Ten PICS systems and two central chillers were deployed to Fernald through this ASTD project. For this estimate, it was assumed that one PICS system was needed for each worker. Each central chiller can accommodate up to five workers via tethers; therefore, a maximum of ten workers can be cooled by the two central chillers. This estimate was based on the conservative assumption that the central chillers were only being used to 60 percent of their capacity – in other words, that only six workers were utilizing them during any given period of heat stress. Therefore, the cost savings estimate was based on a total of 16 workers using the PICS.

Based on a project involving 16 workers using the PICS, annual cost savings would be in the range of 16 x $7,742 or **$124,000**. Over the five-year estimated lifetime of the PICS, the total cost savings would reach approximately **$620,000.**

The cost savings estimate above is based on conditions at Fernald only. It is anticipated that other sites could achieve comparable cost savings, while those that are located in warmer climates could realize even greater savings. To date, more than **200** PICS units have been deployed as a result of this project. Using the assumptions and work hour conditions stated above, the total cost savings generated by these units would exceed **$1.5 million** in just one year.

## Cost Savings Estimate – Oxy-Gasoline Torch

This estimate evaluates the cost and schedule impacts of cutting steel with an oxy-gasoline torch instead of an oxy-acetylene torch. The ITSR for the oxy-gasoline torch (OST Reference #1847) compares its operational costs and performance data to those of the baseline oxy-acetylene torch. Table 4 shows the unit cost and production rates for each torch, along with the pay-back time for the capital cost difference between them. Anomalies in the production rate and operating costs are due to differences in the geometry and accessibility of the components being segmented.

**Table 4. Cost and performance data for the oxy-acetylene and oxy-gasoline torches based on material thickness**

| Thickness (in.) | £ 0.5 | 1.0 | 1.75 | 2.0 | 4.5** | Overall |
|---|---|---|---|---|---|---|
| **Oxy-acetylene Torch** | | | | | | |
| Capital cost | $299 | | | | | |
| Length of Cuts (in) | 166.5 | 35 | 43 | 108 | 4.5 | 357 |
| Time (min) | 45 | 20 | 22 | 49 | 15 | 151 |
| Production Rate (in/h) | 222 | 105 | 117 | 132 | 18 | 142 |
| Unit Cost ($/in) | $0.63 | $1.05 | $1.18 | $1.12 | $7.75 | $1.19 |
| **Oxy-gasoline Torch** | | | | | | |
| Capital cost | $845 | | | | | |
| Length of cuts (in) | 166.5 | 35 | 43 | 120 | 4.5 | 369 |
| Time (min) | 45 | 14 | 19 | 33 | 5 | 116 |
| Production Rate (in/h) | 222 | 150 | 136 | 218 | 54 | 191 |
| Unit Cost ($/in) | $0.62 | $0.92 | $1.01 | $0.64 | $2.53 | $0.90 |
| **Pay-back Time (h)** * | 246 | 28 | 24 | 5 | 2 | 10 |
| **Break even point (in)** | 54,600 | 4,200 | 3,212 | 1,138 | 105 | 1,883 |

* The operating time over which the additional capital cost ($546) of the oxy-gasoline torch will be recovered.
** 4.5 in. diameter axle shaft.

The estimated cost and schedule savings generated by using one oxy-gasoline torch instead of one oxy-acetylene torch to cut 120,000 linear inches of steel at Fernald (representing a potential D&D project) are detailed below. Estimates are based on the following assumptions:

- 30% utilization over one year (52 weeks x 40 hrs./week) provides 624 hrs. of actual torch cutting
- Oxy-gasoline torch cutting rate is 191 inches/hour*
- Oxy-acetylene torch cutting rate is 142 inches/hour*
- Unit cost of operating oxy-gasoline torch is $0.90/inch*
- Unit cost of operating oxy-acetylene torch is $1.19/inch*
- Steel thickness ranges from less than 0.5 inch to greater than four inches*

* Source: Innovative Technology Summary Report #1847

Approximate cost and schedule savings are summarized in the following table:

**Table 5. Estimated savings generated by oxy-gasoline torch use at Fernald**

| TECHNOLOGY | TIME REQUIRED TO CUT 120,000 LINEAR IN. | COST |
|---|---|---|
| Oxy-gasoline Torch (1) | 1 year | $108,000 |
| Oxy-acetylene Torch (1) | 1.35 years | $143,000 |
| **SAVINGS** | ~ 4 months | $35,000 |

As Table 5 illustrates, significant cost and schedule savings can be realized by replacing the oxy-acetylene torch with the oxy-gasoline torch in steel cutting operations. The oxy-gasoline torch could complete the job four months ahead of the oxy-acetylene torch, saving the site $35,000. A typical D&D project may use three crews to segment steel with cutting torches. If they used oxy-gasoline torches instead of oxy-acetylene torches under the conditions described above, they could cut approximately 360,000 linear inches of steel with an estimated cost savings of **$105,000**. Based on a life expectancy of seven years for three oxy-gasoline torches, the site could realize a total cost savings of **$735,000**.

# LESSONS LEARNED

## Sustained Marketing Mindset

For technology deployment to be successful, project personnel must maintain a sustained marketing mindset. The superiority of innovative technology alone is not enough to convince end-users to abandon more familiar baseline technologies and try something new. Labor, financial resources, and time are required to identify deployment locations and to organize effective, hands-on demonstrations and training sessions for end-users. As seen in Figure 4, several different types of resources are needed to provide momentum to deployment projects and overcome the inertia of the status quo. Positive first-hand experience with new technology is a powerful motivating factor for end-users; the "Fernald Approach" provides such experience.

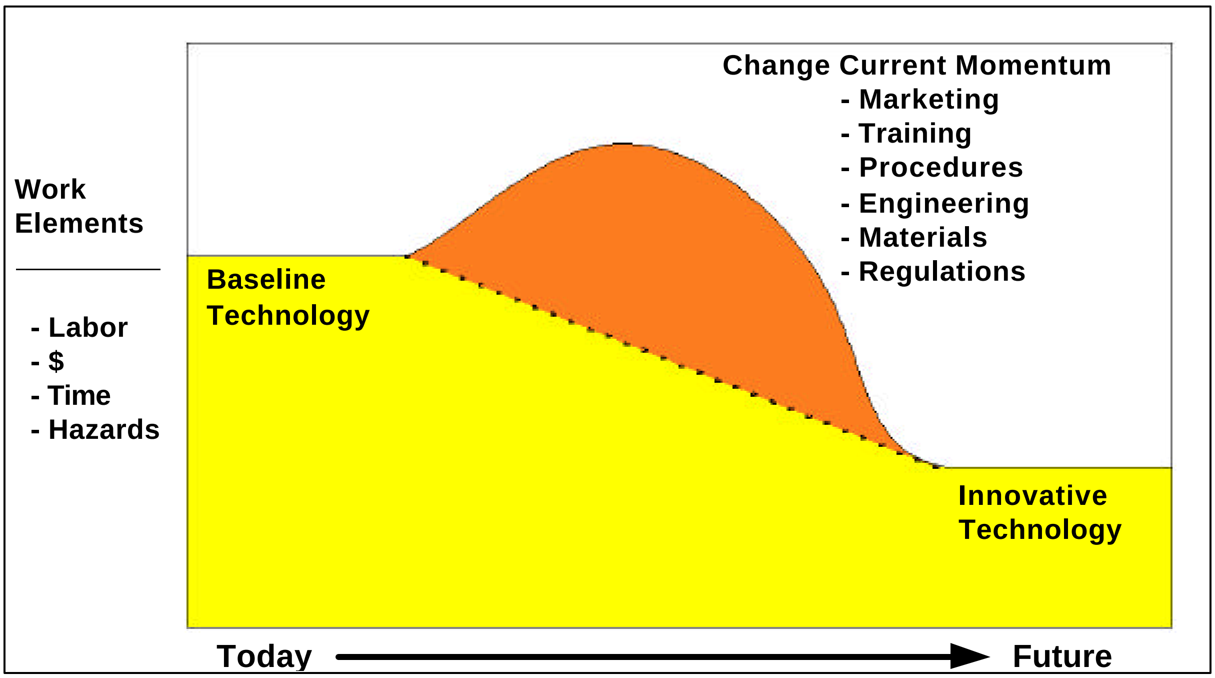


**Figure 4.** The "Fernald Approach" provides the resources necessary to generate "technology deployment activation energy."

To continually improve the effectiveness of technology deployments, resources must also be allocated to follow-up communication with deployment sites. For example, Fernald ASTD Project personnel could have used additional resources to conduct an annual follow-up debriefing with each deployment site. By learning about the positive and negative results of past technology deployments, project personnel could develop an information database that could be used to improve future ASTD projects.

## Communication with Project Managers

The Fernald ASTD Project demonstrated that successful deployments must appeal to the concerns of project managers. Managers are not always intimately familiar with the equipment used in field work, but they are well aware of quantitative factors, such as production rates and cost performance. Many managers understand that, in order to maintain high productivity rates and safety standards, D&D workers should have access to the best equipment for a particular task. The “Fernald Approach” provides management and end-users with a risk-free opportunity to experience winning technologies first-hand (See Figure 5). The approach allows end-users to determine if the technology will work for them, while eliminating the risk to project managers of devoting financial resources to the capital cost of untested equipment. Funding for new technologies typically is not included within a project’s operational budget. Providing seed units at no cost to the project manager avoids this obstacle to deployment.

**Figure 5.** Torch users from the DOE Portsmouth Gaseous Diffusion Plant "test drive" the oxy-gasoline torch at their facility. *7426-18*

This project also illustrated the need for multiple deployments at large DOE sites. Large cleanup sites are often comprised of several layers of management and oversight, along with numerous project areas. In order to reach a representative sample of potential end-users, project personnel should make an effort to contact managers and end-users at various levels throughout the larger sites. Since different project managers will have varying needs, multiple deployments may be required to address the range of projects at each site.

## Deployment Coordination

A final lesson taken from the Fernald ASTD Project is the importance of developing an experienced and knowledgeable deployment team to conduct technology transfer sessions. The team should consist of people who have worked directly with a technology and understand its range of capabilities and applications. When a need for that particular technology is identified elsewhere, the deployment team should be on hand to travel to the deployment site and conduct a technology transfer session. An expert deployment team maximizes the benefit of technology deployments by applying its knowledge to the various conditions and projects encountered at deployment sites, providing end-users and project managers with valuable information that can be used to evaluate the innovative technology’s potential at each site.

# CONCLUSIONS

The Fernald ASTD Project successfully overcame many of the traditional challenges to technology deployment. By encouraging the active participation of technology vendors, end-users, and managers in deployment sessions, Fernald project personnel were able to communicate the benefits of the oxy-gasoline torch and PICS to current and future D&D workers throughout the country. Hands-on demonstrations and the deployment of seed units provided fiscally cautious managers and skeptical end-users a risk-free opportunity to evaluate the capabilities of each technology. Many deployment sites subsequently determined the PICS and oxy-gasoline torch to be worthwhile investments and purchased additional units directly from the vendors. Fernald's efforts add value to the DOE investment in technology demonstrations by ensuring that winning technologies do not fall by the wayside.

The effectiveness of Fernald's technology deployment effort is a testament to the need for greater emphasis on the marketing of new or innovative technologies. Even after a successful demonstration, a new technology does not necessarily "sell" itself, due to a variety of factors. Project managers at other sites may be unaware that an alternative to the baseline exists. Those who do know about new or innovative technologies may lack the time or ability to research which alternatives would best suit their needs. The tight schedules and productivity demands of the D&D industry act as a natural disincentive to try new technologies, since baseline methods are generally "tried-and-true." Aggressive marketing and communication techniques, such as those pioneered through the "Fernald Approach," can significantly improve the chances that a new or innovative technology will be utilized to its fullest potential.

# APPENDIX A

| **Acronym/Abbreviation** | **Description** |
|---|---|
| ASTD | Accelerated Site Technology Deployment |
| D&D | Decontamination and Decommissioning |
| DOE | Department of Energy |
| EM | Environmental Management |
| Fernald | Fernald Environmental Management Project |
| ITSR | Innovative Technology Summary Report |
| LSDDP | Large Scale Demonstration & Deployment Project |
| OST | Office of Science and Technology |
| PICS | Personal Ice Cooling System |
| TPO | Technical Program Officer |

APPENDIX B

## *Fernald ASTD Survey Form*

**HAMMER Site Technology Transfer Survey**

Date: May 5, 2000

Group/organization: UBC

(please check one)
- ☐Field Line Supervisor
- ☒Hourly
- ☐Management
- ☐Other, please list ________

(please check one)
- ☐Direct Operations(D&D, Construction, Maintenance)
- ☐Support (Engineering, Technical,
- ☐Other, please list __________

**COPY**

1. Was the presentation worth your time? (please circle one)

   Poor Excellent
   1 2 3 4 5

2. Would you attend a similar presentation on other technologies? (Circle Y for Yes, N for No)

   Y / N

3. Please rate this method (presentation) for learning about a technologies? (please circle one)

   Poor Excellent
   1 2 3 4 5

4. Estimate the number of employees at your site that would benefit from a heat stress relief.

   0 to 10 11 to 20 21 to 50 >50

4a. Estimate the number of employees at your site that would benefit from improved torch cutting operations.

   0 to 10 11 to 20 21 to 50 >50

5. Identify the current method(s) for heat stress control: (Circle all that apply)

   A. Stay time B. Ice vest C. Physiological Monitoring
   D. Altered Work Schedule E. Vortex/air cooling F. Other, please list ____________

5a. Identify the current method(s) for cutting steel: (Circle all that apply)

   A. Oxy-Acetylene Torch B. Plasma Arc C. Sawing
   D. Shearing E. Abrasive Wheel Saw F. Other, please list ____________

6. Name the latest new/innovative technology that you have been made aware of or know has been deployed at your site within the last 12 months. (Fill in the blank)

   ______________________________________________

7. Is there resistance to technologies that improve productivity? (Circle Y for Yes, N for No)

   Y / N

8. Does your group/organization consult any of the below sources of information:

| | | | |
|---|---|---|---|
| ITSR | Y or N | Green Book | Y or N |
| Web Sites | Y or N | Factsheets | Y or N |
| Video | Y or N | STCG | Y or N |
| EM50 | Y or N | | |

COPY

# Fernald ASTD Survey Form (page 2)

9. What is the #1 challenge to implementing the cool suit technology? (Circle all that apply)
   - A. Procedures
   - B. Management
   - C. Workers
   - D. Funding
   - E. Training
   - F. Logistics

9a. What is the #1 challenge to implementing the Oxy-Gasoline Torch technology? (Circle all that apply)
   - A. Procedures
   - B. Management
   - C. Workers
   - D. Funding
   - E. Training
   - F. Logistics

10. Who else could benefit from the technologies presented at this meeting?(Name & organizaton)

Center to protect workers rights

Other comments: (please suggest improvements to this presentation)

# APPENDIX C

FINDLAY

THE UNIVERSITY OF FINDLAY

*National Center of Excellence*
*for Environmental Management*

Fernald Environmental Management Project
C/o Mark Peters, MS-43
P.O. Box 538704
Cincinnati, OH 45253-8704

COPY

Dear Mr. Peters,

On behalf of The University of Findlay's Environmental Resource Training Center (ERTC), I would like to thank FDF Technology Programs for presenting the benefits of the Cool Suit (Personal Ice Cooling System – PICS). We can clearly see the advantages of the PICS to mitigate heat stress when workers are wearing the required Personal Protective Equipment for extended periods of time. Heat stress is a very serious concern and the workers need every possible assistance in combating heat stress.

We are very interested in the Department of Energy-Fernald and Fluor Daniel Fernald's Technology Programs technology transfer program. We would like to participate in your program by incorporating PICS into the ERTC training programs. The ERTC is a leading institution for educating/training personnel working in the environmental remediation field. Through the ERTC, we train and educate about 9000 personnel each year from across the United States. We have trained personnel from the DOE Complex (Mound – OSHA 29 CFR 1910.120), private industry, other government entities (EPA, Fire Departments, Police Departments, DOT, Emergency Responders, etc.) and the Universities' "traditional" students.

To effectively integrate the cool suits into our curriculum, My staff estimates that we would need six vest type and six 3 piece cool suit systems and their supporting equipment. Please see the attached list for details.

We look forward to meeting with you to finalize the details of the technology transfer. I would suggest meeting in Findlay during the month of December 1999, to tour our training facilities and work out the details of the transfer.

Once again, thank you for sharing this valuable, leading edge Health and Safety technology and for providing the opportunity to participate in a unique and valuable program.

Sincerely,

J. R. V. D.

J. Randal Van Dyne
Executive Director

| | | |
|---|---|---|
| Cc. | John Bradburne | FDF |
| | Bob Heck | FDF |
| | Keith Wilkerson | FDF |
| | Robert Danner | DOE-Fernald |
| | Dan Hehr | UF |

1000 North Main Street
Findlay, Ohio 45840-3695
Ph: 1-800-521-1292 Fax: 419-424-5303

CITY OF NOGALES

**LUIS S. PADILLA**
**Fire Chief**

March 23, 2000

Ms. Susan R. Brechbill, Manager
Ohio Field Office
United States Department of Energy
1 Mound Road
Miamisburg, OH 45342

COPY

Dear Ms. Brechbill:

On behalf of the Nogales Fire Department/Hazardous Materials Response Team, I would like to extend my sincere thanks to the U.S. Department of Energy (DOE) for deploying the Personal Ice Cooling System (PICS) to our community. In particular, I want to emphasize the leadership of the DOE's Carlsbad Area Office for organizing the demonstration of PICS and the generosity of the Ohio Field Office for making this technology available to us. We are very pleased with receiving the PICS given our need for such a technology and view the DOE initiatives that brought them to us very favorably.

The rapid growth and development of economic activity along the U.S.-Mexico border region has resulted in ever increasing quantities of hazardous materials moving in and around the area. This increase has resulted in a corresponding increase in the number of calls we respond to for hazardous materials spills, etc. Our hot climate, coupled with the personal protective equipment (PPE) that our response teams use, makes heat stress a serious concern. My department is very enthusiastic about utilizing the PICS to reduce heat stress and increase comfort and safety while dressed out in PPE. After personally witnessing the positive reaction of my men who tried out the PICS during the deployment/training session conducted here, I believe that the PICS will be effective in combating heat stress.

I would like to express my thanks to Robert Danner of DOE-Fernald, Sue Countiss of DOE-Carlsbad, Marty Prochaska of Fluor Fernald, Kirk Dobbs of Delta Temax (manufacturer of the PICS), and Richard Jimenez and Eli Maestas of Applied Sciences Laboratory. I also thank both the DOE sponsored Fernald Accelerated Site Technology Deployment (ASTD) project and the DOE-Carlsbad sponsored U.S.-Mexico Border Region Technology Deployment Initiative for Hazardous Wastes for making this innovative technology available to us. We are grateful to receive this technology, which will help our team members safely and efficiently respond to hazardous materials incidents.

Sincerely,

Luis S. Padilla
Fire Chief
City of Nogales

777 NORTH GRAND AVENUE · NOGALES, ARIZONA 85621 · (520) 287-6571 · FAX: (520) 287-2230 · T.D.D. (520) 287-5477

APPENDIX D

# USERS SPEAK OUT ON TECHNOLOGY DEPLOYMENT

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## List of Tables



## List of Figures

# Executive Summary

This report summarizes user feedback data collected during a recent Accelerated Site Technology Deployment (ASTD) project: the Fluor Fernald ASTD Technology Deployment Project from May, 1999 through September, 2000. The main goal of the ASTD project was to use the "Fernald approach" to expedite the deployment of new or innovative technologies with superior safety, cost, and/or productivity benefits to Department of Energy (DOE) facilities. The Fernald approach targets technology end-users and their managers and directly involves them with hands-on demonstrations of new or innovative technologies during technology transfer sessions. The two technologies deployed through this project were the Personal Ice Cooling System (PICS) and the oxy-gasoline torch. Participants of technology transfer sessions were requested to complete feedback surveys. Surveys evaluated the effectiveness of the Fernald approach to technology deployment and assessed the responsiveness of employees to new technologies. This report presents the results of those surveys.

In total, 249 surveys were completed and analyzed for this report. Survey questions were designed to address the following aspects of the ASTD project: 1) determine whether the target audience was reached; 2) evaluate the effectiveness of the technology transfer presentations; 3) estimate the need for PICS and oxy-gasoline torch technologies; 4) learn about competing technologies; 5) identify valuable learning tools for employees; and 6) identify obstacles which delay the widespread use of new technologies.

Based on the data collected, the target audience (technology end-users and their managers) was reached through Fernald's technology transfer session. Those who attended the session found it to be a worthwhile and effective learning tool. Results suggest that PICS technology would benefit most sites throughout the DOE complex, while a smaller market exists for the oxy-gasoline torch. Several alternative techniques are currently used to combat heat stress, while the main competitor for the oxy-gasoline torch appears to be the oxy-acetylene torch. Respondents generally utilize tools such as web sites and fact sheets to learn about new technologies; these resources can supplement hands-on presentation methods. Lastly, survey results indicate that management and funding are viewed as major obstacles to the deployment of the PICS and oxy-gasoline torch.

The trends that emerged through analysis of these surveys can prove beneficial to future deployment efforts. DOE/Fernald can use this feedback to improve its presentation methods and address specific employee concerns, though survey results suggest that the DOE/Fernald technology deployment projects have already achieved considerable success. An overwhelming majority (> 91 percent) of respondents rated the presentation methods employed in technology transfer sessions to be above average or excellent, and nearly 99 percent of respondents would attend a similar presentation on other technologies. These figures indicate that Fernald's innovative and active approach should be replicated in future deployment efforts. The overall success of Fernald's deployment effort is best summed up by one respondent who said, "Keep up the good work – more tech transfer!"

## 1.0 Introduction

This report summarizes data collected from technology end-users who participated in the Fernald ASTD Technology Deployment Project. The project's main goal was to expedite the deployment throughout the DOE complex of new or innovative technologies that were determined to have superior safety, cost, and/or productivity benefits. Using the Fernald approach, the ASTD project targeted PICS/oxy-gasoline torch end-users and their managers, involving them in a hands-on demonstration of each technology. This project also furnished them with technology-specific training and provided end-users with technology seed units, when applicable. Figures 1 and 2 illustrate activities conducted during technology transfer sessions.

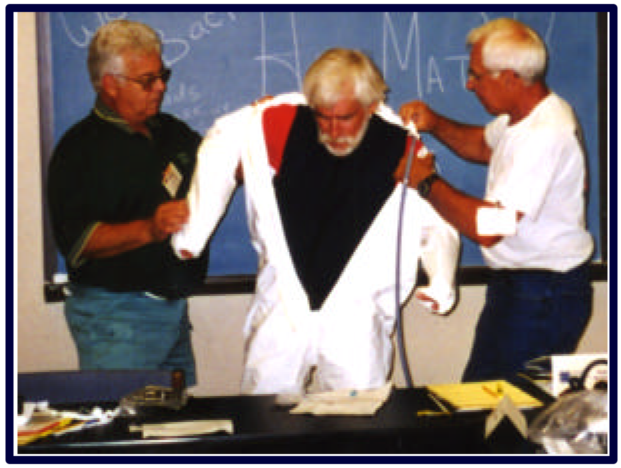

**Figure 1**: Hands-on demonstration of Personal Ice Cooling System during technology transfer session.

**Figure 2**: Workers observing oxy-gasoline torch demonstration during technology transfer session.

During technology transfer sessions, participants were requested to complete surveys for evaluation of the project's effectiveness. The main purpose of this report is to summarize survey results and identify trends in the data. This information can be used, in part, to evaluate the success of past presentations, to assess the responsiveness of employees to new technologies and to improve Fernald's technology deployment approach for future deployments.

## 2.0 Methods

This report focuses on the deployment of two technologies: the PICS and the oxy-gasoline torch. At present, Fluor Fernald has deployed these technologies to 24 sites nationwide, 18 of which have completed and returned feedback surveys to Fernald. Table 1 is a list of deployment sites that participated in the evaluation process and their selected technologies. Subsequent PICS and/or oxy-gasoline torch purchases, which were initiated and financed independently of the Fernald deployment project, are also listed.

Table 1: PICS/Oxy-Gasoline Torch Deployment Sites

| SITE | PICS | OXY-GAS TORCH | SUBSEQUENT PURCHASES | |
|---|---|---|---|---|
| | | | PICS | TORCH |
| Ashtabula | ✓ | ✓ | | |
| Carlsbad | ✓ | | | |
| Center to Protect Workers Rights | ✓ | | | |
| Hanford | ✓ | ✓ | ✓ | ✓ |
| Lawrence Livermore National Laboratory | ✓ | | | |
| Los Alamos National Laboratory | ✓ | | | |
| Mound | ✓ | | | ✓ |
| Nevada Test Site | ✓ | | | |
| Oak Ridge | ✓ | | ✓ | ✓ |
| Paducah Gaseous Diffusion Plant | ✓ | | ✓ | |
| Pantex | ✓ | | ✓ | ✓ |
| Portsmouth Gaseous Diffusion Plant | ✓ | ✓ | ✓ | ✓ |
| Rocky Flats | ✓ | | | ✓ |
| Sandia National Laboratory | ✓ | | | |
| Savannah River | ✓ | | ✓ | |
| University of Findlay Environmental Response Training Ctr. | ✓ | | | |
| Volpentest HAMMER Facility | ✓ | ✓ | | |
| West Valley Demonstration Project | ✓ | ✓ | | ✓ |

To evaluate the effectiveness of the technology deployment project, survey questions were designed to address specific aspects of the project. These aspects are listed below:

1. Determine whether the target audience was reached. The target audience consisted of technology end-users such as hourly employees, field line supervisors, and their direct managers.
2. Ascertain whether technology transfer presentations were well executed and effective as a means of learning about new technologies.
3. Obtain a better understanding of the potential need for PICS and oxy-gasoline torch technologies throughout the DOE complex.
4. Find out which competing technologies are currently being used.
5. Discover which information resources are most valuable to those seeking new technologies.
6. Determine what obstacles, if any, thwart the implementation of new technologies.

Two hundred and forty-nine surveys were included in the analysis. Appendix A is a sample of the survey form used. The twelve questions remained constant for all sites surveyed with the exception of questions six, seven and eleven. Since the survey was originally developed prior to torch deployments, a supplemental part (a) was added to each of these questions to accommodate the deployment of the oxy-gasoline torch.

Survey responses were analyzed using Microsoft Excel. Only those who answered a particular question were included in the analysis of that question; non-responses were eliminated. Percentages were then obtained by dividing the number of responses in each category by the number of total respondents to the question. Respondents were able to choose more than one answer to questions 7, 7(a), 10, 11 and 11(a). Percentages continued to be obtained by dividing the number of responses in each category by the number of total respondents to the question. However, since the same respondent could have chosen multiple answers, adding up the percentages across all categories will result in a figure greater than 100 percent for these five questions. It should also be noted that the number of total respondents was lower for questions regarding the oxy-gasoline torch (*), since this technology was not deployed to all of the surveyed sites. Total respondent counts for each question are summarized below:

- Question 1: 228
- Question 2: 218
- Questions 3 & 4: 249
- Question 5: 246
- Question 6: 238
- Question 6(a): 31*
- Question 7: 238
- Question 7(a): 25*
- Question 9: 215
- Question 10: 135
- Question 11: 207
- Question 11(a): 20*

Questions 8 and 12 required open-ended responses and were not quantified in this paper. The next section of this report will summarize survey responses.

## 3.0 Results and Discussion

Questions 1 and 2 asked for the employee's job classification and description (See Figs. 3 and 4). The individual percentages indicated a relatively even distribution of respondents, particularly hourly employees, field line supervisors and their direct managers, who were the main targets of the presentation. However, it should be noted that the sites surveyed are not homogenous: they vary by factors such as size, number of employees, and duties being performed. Based on these results, it is apparent that the target audience has been reached through the technology transfer sessions.

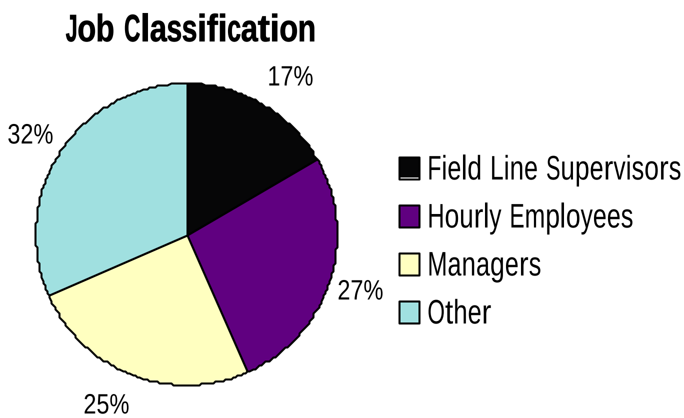


**Figure 3:** General employee classification of survey respondents.

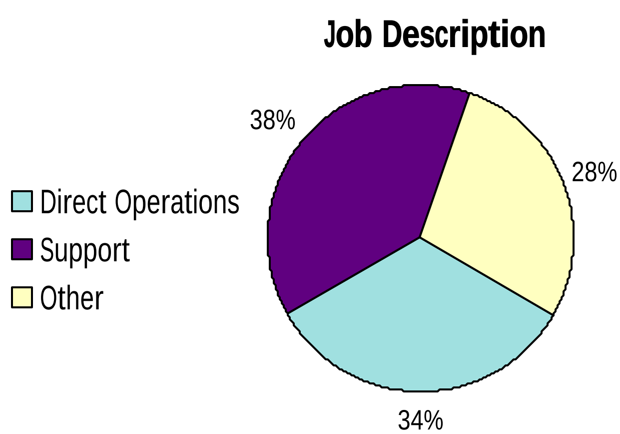


**Figure 4:** Job description of survey respondents.

Questions 3 through 5 targeted the respondents' opinion of the presentation. As illustrated by the graphs below, responses were positive. Analysis of question 3 indicates that over 90 percent of respondents believed the presentation to be well worth their time (See Fig. 5). Though responses to question 4 are not represented pictorially, results showed that nearly 99 percent of respondents would attend a similar presentation on other technologies.

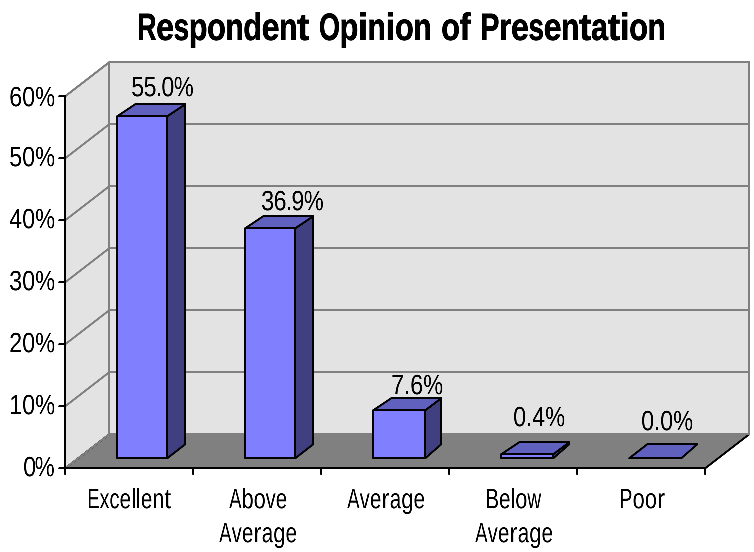


**Figure 5:** Respondents' evaluation of whether presentation was worth their time.

Attendants also favored the Fernald approach as a way of learning about technologies, as evidenced by responses to question 5 (See Fig. 6). Once again, over 90 percent believed the interactive presentation method to be above average or better. The results of these three questions support the idea that the Fernald approach to technology deployment is beneficial to the DOE, workers in the field, and site contractors.

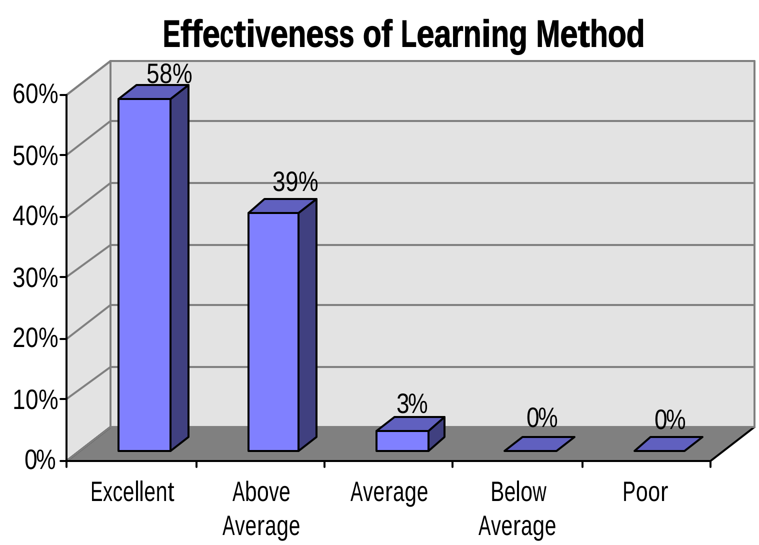


**Figure 6:** Respondents' opinion of presentation method as a learning tool.

The purpose of question 6 was to approximate the number of people at each site who need help mitigating heat stress. Half of the respondents estimated that more than 50 people at their site would need such assistance (See Fig. 7). This data can be interpreted to mean that heat stress is a potential problem at many DOE sites.

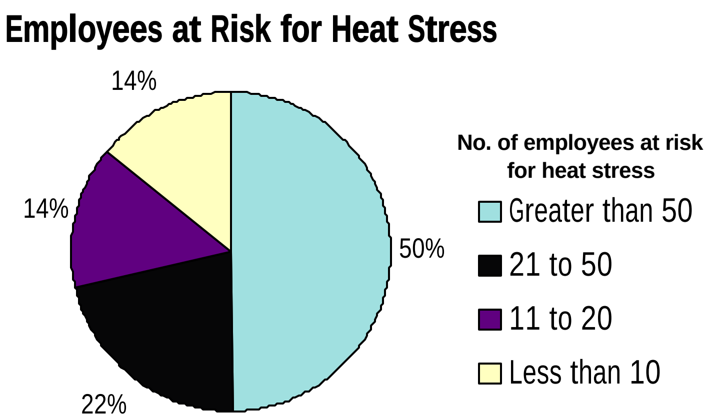


**Figure 7:** Estimated number of employees at each site who need help mitigating heat stress.

Responses to question 6(a) showed that 45 percent of respondents estimated that less than 10 people at their site would benefit from improved torch-cutting technology (See Fig. 8). Questions like these can be used to estimate the size of the market, or need, for each technology and to determine where demand exists. Results suggest that the potential market for the PICS is much larger than that for the oxy-gasoline torch. These results are supported by the fact that more workers are required to "dress out" in personal protective equipment to perform various jobs than those required to use an open-flame steel cutting device.

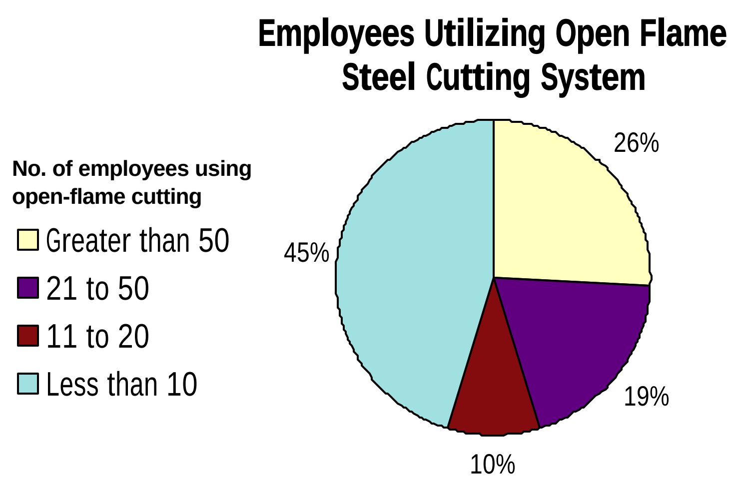


**Figure 8:** Estimated number of workers at each site who would benefit from improved steel-cutting technology.

Methods used to combat heat stress were explored in question 7. The question was designed to identify other technologies or practices that compete with the PICS. Based on survey responses, the three most common were limiting stay time, altered work schedules and ice vests (See Fig. 9). Three-fourths of respondents indicate that limiting stay time, a highly expensive practice, is a standard method of heat stress control at their site.

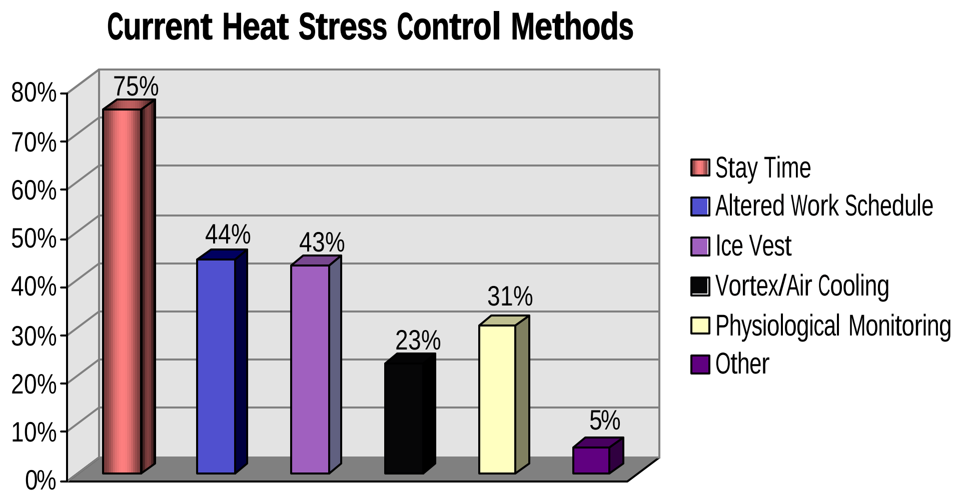


**Figure 9:** Heat stress control methods currently used by workers at survey sites.

Currently used steel segmentation methods are examined in question 7(a). In much the same way, this analysis identifies technologies that compete with the oxy-gasoline torch. By far, the most common steel cutting instrument is the oxy-acetylene torch, which is used by 100 percent of those responding to the question (See Fig. 10). The benefit of this data is that it enables Fernald to custom-design presentations to the needs of each deployment site by comparing new technologies to the site's most widely used methods.

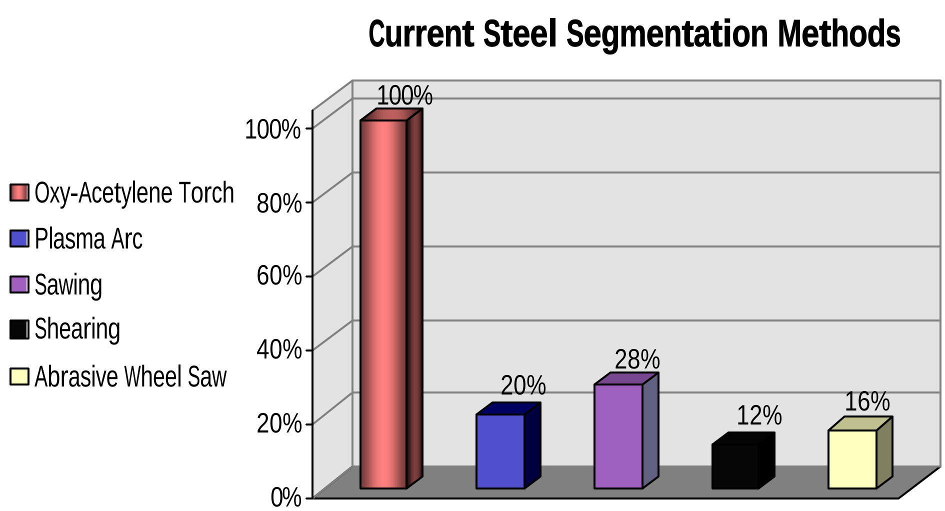


**Figure 10:** Steel cutting techniques currently used by workers at surveyed sites.

Question 10 asked respondents to identify information resources that they use to learn about new technologies. Results indicated that web sites, fact sheets, and Innovative Technology Summary Reports (ITSRs) are the most frequently accessed learning tools. Web sites are used by 64 percent of survey respondents; fact sheets are used by 48 percent, and ITSRs are used by 29 percent (See Fig. 11). Such data is valuable because it displays trends in the flow of information; these trends can be used by DOE/Fernald to effectively advertise or market new technologies.

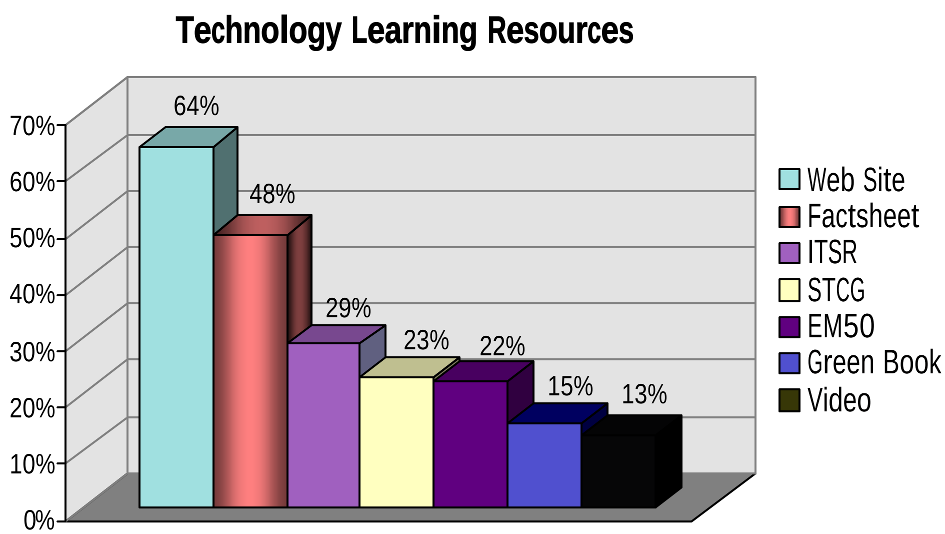


**Figure 11:** Methods commonly used by survey respondents to learn about new technologies.

Although the results of question 10 are valuable, it should be noted that only 135 (~54 percent) of the 249 survey respondents answered the question. Such a low response rate could be explained by several factors. Certain groups of survey respondents may be more inclined than others to research new technologies. Trainers or managers, for example, might actively perform such research in order to remain apprised of industry developments. Also, those in management or training positions may have better access to information resources than hourly employees. Another possibility is that workers utilize other information resources (e.g., word of mouth) that were not represented in the answer choices for question 10 on the survey form.

Questions 9, 11 and 11(a) targeted obstacles to the implementation of new technologies. Specifically, question 9 asked if there was any resistance to technologies that improve productivity. Of those who addressed the question, nearly 30 percent feel that there is some resistance. Respondents were then asked in questions 11 and 11(a) to name the greatest challenge facing the PICS and the oxy-gasoline torch, respectively. High percentages in any category could serve to highlight specific issues that should be addressed in the presentation of new technologies. In this case, funding was cited by 55 percent as the most serious obstacle facing the PICS (See Fig. 12). The challenges to oxy-gasoline torch implementation are more evenly distributed, with funding and management each capturing 35 percent of the respondent total (See Fig. 13).

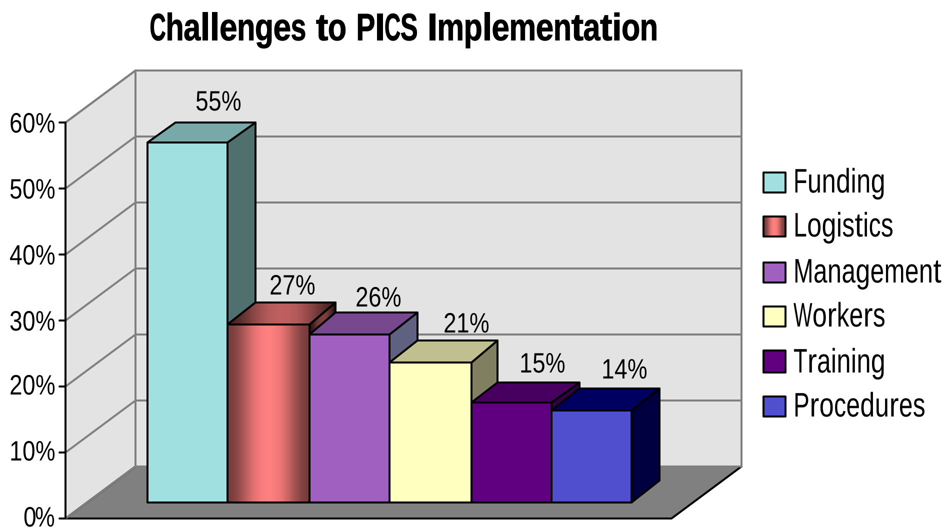


**Figure 12:** Elements identified by respondents as major obstacles to PICS implementation at their site.

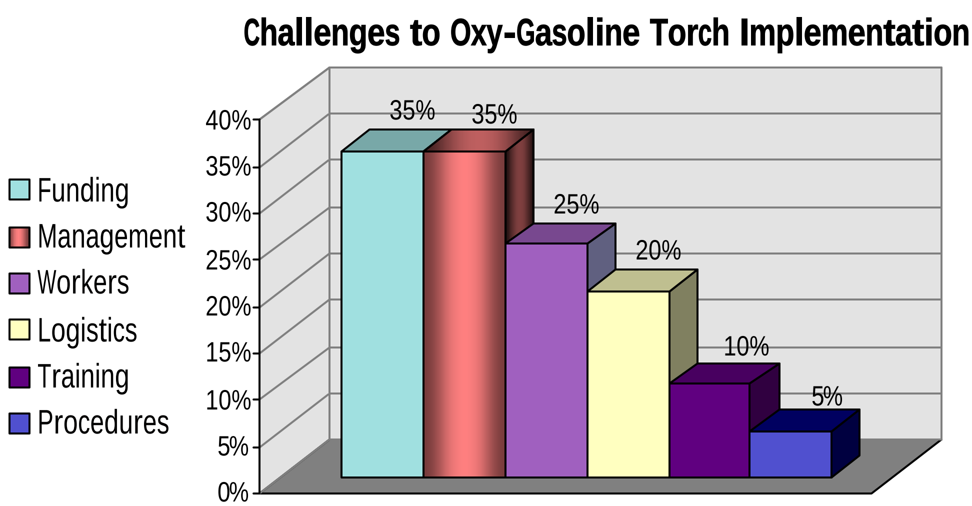


**Figure 13:** Elements identified by respondents as major obstacles to oxy-gasoline torch implementation at their site.

Comparing the results of questions 11 and 11(a) uncovers several potentially important issues. Question 11 asked respondents to identify the foremost challenges to PICS implementation, while question 11(a) asked the same with respect to the oxy-gasoline torch. Management is considered to be one of the two major obstacles to torch implementation, but only the third most significant impediment to PICS use. In both cases, management is considered to be a greater obstacle than workers. This result was somewhat surprising, since one might predict that workers would be more reluctant to adopt new technologies than managers, who should favor the most efficient processes. These observations could mean that managerial attitudes are based on misconceptions about new technologies. Concerns about the hazards of gasoline, for example, might prevent some project managers from using the oxy-gasoline torch, even though the oxy-gasoline torch is actually safer than the industry standard oxy-acetylene torch. Alternatively, the perceptions of survey respondents might not be entirely accurate. Workers, for example, might be reluctant to consider themselves a "challenge" to new technology implementation; far more surveys were completed by workers than by managers. It should also be noted that while 207 people responded to question 11, only 20 responded to question 11(a), since the PICS was deployed on a much wider scale than the torch.

## 4.0 Conclusions

Overall, analysis of the feedback survey data collected from this ASTD project indicates that people are receptive to learning about new technologies. Those surveyed particularly favor the "hands-on," seed unit approach pioneered by Fernald. It can be concluded that the Fernald approach can be profitable to all parties involved. The risk of heat stress is a potential problem common to DOE sites across the nation. Furthermore, because many sites throughout the country are in the D&D phase, there is a high demand for inexpensive, safe, and expeditious steel cutting technology. The trends that emerge through analysis of these surveys can be quite beneficial to future deployment efforts. DOE/Fernald can use this feedback to develop more effective presentation methods and to address the particular needs of a given audience.

## 5.0 Future Recommendations

In general, survey questions effectively targeted the critical aspects of the ASTD project. However, there is room for improvement in future efforts. Survey designers should pay particular attention to the wording of questions in order to avoid influencing responses. For example, question 9 in this survey asks, "Is there resistance to technologies that improve productivity?" Respondents may be reluctant to answer in the affirmative, simply to avoid the perception that their peers are unconcerned with productivity. A more neutral question 9 would read, "Is there resistance to new or alternative technologies?" Question 6 should be reworded to obtain more concise information. The question currently reads, "Estimate the number of employees at your site that need help with mitigating heat stress." A less ambiguous version of Question 6 would read, "Estimate the number of employees at your site that may be at risk for heat stress while performing work."

Survey planners would also benefit by ensuring that multiple choice selections are appropriate, comprehensive and congruent with the questions. Planners should restructure the answer selection in Question 3 to fit the question. Question 3 asks, “Was the presentation worth your time?” Possible answers range from “Excellent” to “Poor.” The selections do not relate to the question, which could be answered with a simple yes or no. Another option might be to reword the question to fit the original selections. A better question might be, “How would you rate the quality of the presentation?” Questions 10, 11 and 11(a) ask the respondent to select from a list of items. However, no “Other” option is provided. Including an “Other” field may have prompted responses that could not have been predicted by the survey designer.

Minor modifications such as those described above can improve the quality of survey results. Carefully designed questions and prudent analyses will allow survey data to become an integral part of technology deployment projects in the future.

## APPENDIX A – SAMPLE SURVEY

### Site Survey of the Fernald Technology Transfer Program

Date: _________________

Group/Organization: ________________________________________________

1. (check the one box that best describes you)
☐ Field Line Supervisor / Maintenance
☐ Hourly
☐ Management
☐ Other, please list _____________________

2. (check the one box that best describes you)
☐ Direct Operations (D&D, Construction, etc.)
☐ Support (Engineering, Technical, etc.)
☐ Other, please list __________________

3. Was the presentation worth your time?
(please circle one)
Poor Excellent
1 2 3 4 5

4. Would you attend a similar presentation on other technologies?
(please circle one)

Yes No

5. Please rate this method (presentation, hands on training) for learning about technologies.
(please circle one)
Poor Excellent
1 2 3 4 5

6. Estimate the number of employees at your site that need help with mitigating heat stress.
(please circle one)
0 to 10 11 to 20 21 to 50 50+

6(a). How many employees are trained on and use an open flame steel cutting system (e.g. oxy-acetylene torch)?
(please circle one)
0 to 10 11 to 20 21 to 50 50+

7. Identify your site's current method(s) for heat stress control:
(please circle all that apply)

A. Limited Stay Time B. Ice Vest C. Physiological Monitoring
D. Altered Work Schedule E. Vortex/air cooling F. Other, please list_______________

7(a). What is your site's current method to cut/segment steel?
(please circle all that apply)

A. Oxy-Acetylene Torch B. Plasma Arc Cutting C. Reciprocating saws
D. Hand-held hydraulic shears (emergency rescue type) E. Portable band-saws
F. Other, please list __________________________

8. Name the latest new/innovative technology that you have been made aware of or know has been deployed at your site within the last 12 months.

____________________________________________

9. Is there resistance to technologies that improve productivity?

Yes No

10. Check the items below that you have used (or are aware of) to learn about Technologies: (Please check all that apply)

- ☐ ITSR
- ☐ Web sites
- ☐ STCG
- ☐ Green Book
- ☐ Factsheets
- ☐ EM50

11. What do you think is the #1 challenge to implementing the cool suit technology? (Please circle all that apply)

A. Procedures
B. Management
C. Workers
D. Funding
E. Training
F. Logistics

11(a). What do you think is the #1 challenge to implementing the oxy-gasoline torch technology?
(Please circle all that apply)

A. Procedures
B. Management
C. Workers
D. Funding
E. Training
F. Logistics

12. Who else could benefit from the technologies presented at this meeting? (Please provide contact name and organization)

Other comments: (Please suggest improvements to this presentation)

THANK YOU!